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ABSTRACT

The purpose of this study was to compare with an alcohol information warning card the utility of two common alcohol nomograms (statistical information tables) in impacting decisions regarding drinking, driving after drinking, the development of knowledge of the relations between personal alcohol consumption and the legal level of intoxication, and consumer evaluation measures. A total of 159 subjects (65 males and 94 females) attending a 2-day health fair at a southern university participated in this study. Subjects were randomly assigned to one of five conditions by shaking a large plastic die at an alcohol information booth at the fair. Conditions included three treatments (two alcohol nomogram conditions, and one alcohol information card comparison condition), and two conditions of administration (brief instruction, and no instruction). Subjects completed an Alcohol Card Questionnaire six weeks after the conclusion of the health fair. Two commonly found alcohol nomograms were no more effective than an information card warning of the penalities for driving while intoxicated offenses under new state laws. Subjects receiving the information cards were more likely to have made decisions about driving after drinking. A greater percentage of subjects who had not received instruction had read the card than those who had received instruction. The implications of these results and recommendations for future research are discussed. (Author/JD)

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Information on Blood Alcohol Concentration: Evaluation of Two Alcohol Nomograms

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INFORMATION ON BLOOD ALCOHOL CONCENTRATION: EVALUATION OF TWO ALCOHOL NOMOGRAMS

ABSTRACT

The purpose of this study was to compare the utility of two common alcohol nomograms (tables) on impacting decisions regarding drinking, driving after drinking, the development of knowledge of the relations between personal alcohol consumption and the legal level of intoxication, and consumer evaluation measures, compared to an alcohol information warning card. A total of 159 subjects (65 males and 94 females) attending a two-day health fair at a southern university participated in this study. Subjects were randomly assigned to one of five conditions by shaking a large plastic die at an alcohol information booth at the fair. Conditions included three treatments (two alcohol nomogram conditions, and one alcohol information card comparison condition), and two conditions of administration (brief instruction, and no instruction). Subjects completed an Alcohol Card Questionnaire six weeks after the conclusion of the health fair. Two commonly found alcohol nomograms were no more effective than an information card warning of the penalties for DWI offenses under new state laws. Subjects receiving the information cards were more likely to have made decisions about driving after drinking. A greater number of subjects who had not received brief instruction had read the card, compared to those who had received instruction. The implications of these results and recommendations for future research are discussed.

INTRODUCTION

An unprecedented number of self-help instructional materials have been developed in the health care field.[1] These materials come in a multitude of formats including pamphlets, charts, cards, booklets, newletters, magazines, manuals, books, audio and audio-visual tapes, records, computer software, toys, games, and devices of various sorts. Together these materials hold the promise of reaching greater numbers of consumers, at lower cost and more quickly than conventional health care programs. The development and promotion of self-help instructional materials, each promising success in the form of increased knowledge, attitude modification, behavior change, or enhanced health can be expected to continue in the future.[2] The need for designing and conducting research evaluating self-help materials in naturalistic settings therefore continues to be important if we are to understand the range and limitations of these materials for affecting healthy changes.

One type of self-help materials are those used for teaching, training and research on blood alcohol concentration (BAC).[3] One category of BAC paraphernalia are the alcohol nomograms (tables). These devices, as well as information on blood alcohol concentration in general, are common components of alcohol education, traffic safety education and public information efforts. Alcohol nomograms provide information which permit a person to estimate maximum or peak BAC, based on a limited set of variables such as body weight, the number of drinks consumed and the length of time spent drinking. Nomograms come in various forms including charts, wallet-sized cards, micro-computer software and calculator devices.[3] These paraphernalia are found in magazines, newspapers and textbooks, and are distributed by alcohol producers, state and national highway safety programs, and commercial manufacturers.

The assumption under which alcohol nomograms are produced and distributed is that they provide important information which some individuals require to make intelligent decisions about drinking, and driving after drinking. Research on the utility and effectiveness of alcohol nomograms is limited however.[4-6]

The extent to which people actually use alcohol nomograms and the information they provide to make drinking, and driving after drinking decisions is not known. A recent study indicated that blood alcohol concentration feedback from either a breathalizer or an alcohol guide (nomogram) did not influence whether individuals drove afterward.[4] This study, however, was limited to individuals who had already consumed alcoholic beverage at a drinking establishment. Therefore decision-making ability (i.e. whether or not to drive) may have already been impaired prior to the dissemination of BAC information. Todate, few studies have compared various forms of alcohol nomograms to determine differences in the effectiveness among these devices.

The purpose of this study was to examine the utility of two common forms of alcohol nomograms on impacting decisions regarding drinking, driving after drinking, the development of knowledge of the relations between personal alcohol consumption and the legal level of intoxication, and consumer evaluation measures, compared to an alcohol information warning card. This study also examined the effect of brief verbal instruction as a moderating variable.

METHOD

Subjects

A total of 159 subjects (65 males and 94 females), attending a two-day health fair at a southern university, participated in this study. Subjects were those who responded to a mailed questionnaire, from a total of 250 individuals who were sent the questionnaire (63 percent return rate). The mean age of the subjects was 25.3 years (SD=9.6). The majority of subjects were white (85.5%) and single (71.7%). The frequency with which subjects reported drinking alcoholic beverages was: 1) every day, 1%, 2) at least once a week but not every day, 20%, 3) at least once a month but less than once a week, 27%, 4) more than once a year but less than once a month, 20%, 5) once a year or less, 13%, and 6) never, 9%. The majority of subjects reported to drive a motor vehicle (88%). The mean number of times subjects reported to drive after drinking in a typical month was .96(SD=2.2). Chi-square and one-way analysis of variance

tests showed that subjects did not differ significantly between conditions on sex, age, race, marital status, how often they drink alcoholic beverages, whether or not they drive a motor vehicle, and how many times they drive after drinking in a typical month ($p > .05$).

Procedure

Subjects were randomly assigned to one of five conditions (two alcohol nomogram conditions, two conditions of administration, and one comparison condition). The two alcohol nomogram conditions consisted of: 1) a Know Your Limits wallet-size card condition, and 2) a highway safety Drink/Drive Calculator wheel condition. Two conditions of administration of alcohol nomograms consisted of: 1) a brief instruction condition, and 2) a no instruction condition. A final condition consisted of an alcohol information card comparison condition.

The conditions were assigned a number one through six, by shaking a die prior to data collection. Participants at the health fair were asked to stop at an alcohol information booth and shake a die to "win a free alcohol gift." The number each individual shook, using the die, determined the condition to which they were randomly assigned.

Two hundred and fifty health fair participants were mailed an "Alcohol Card Questionnaire" and a cover letter describing the purpose and value of the study. Addresses were obtained from subjects during a preregistration process for the health fair. Subjects not returning the questionnaire were sent a second copy of the instrument and a follow-up letter. Subjects who had not returned the questionnaire after the follow-up, but who had identified a local telephone number during preregistration, were called to solicit their assistance in completing the questionnaire. Those individuals who needed another copy of the questionnaire were sent one at this time.

Research personnel (5 women and 2 men) included six research assistants plus the principal investigator. These individuals were responsible for seeing that each participant at the alcohol booth shook the die and was administered the appropriate condition. Research personnel recorded each participant's

health fair identification number and the specific condition administered, so that conditions and subject names and addresses could be matched for mailing questionnaires. All research assistants were observed during the health fair, by the primary investigator, to ensure that procedures were being followed as prescribed.

Five of the six research assistants received training on how to administer the conditions at a training session held by the investigator. Research assistants were given samples of both alcohol nomograms and the information card, and a handout on the relations between specific blood alcohol concentrations (BAC) and behavioral and physical effects of alcohol. Each assistant practiced using both types of alcohol nomograms to determine BAC from the number of drinks consumed and vise versa. Instruction was given on the potential uses of alcohol nomograms.

Research assistants role played administering conditions, answering questions, and giving instruction, with the investigator. Assistants were also asked to take the alcohol nomograms home and study them, to reinforce their familiarity with them. One research assistant was not able to attend the training session. This person was given individual instruction on the alcohol nomograms, and procedures for administering conditions, prior to working at the health fair.

This study used a posttest only randomized comparison group research design. This design was selected due to its efficiency and applicability to a health fair setting. Data analysis were conducted using a microcomputer software package.[7] All hypotheses were tested at the .05 significance level.

Conditions

Drink/Drive Calculator wheel nomogram condition. The Drink/Drive Calculator nomogram (Datalizer Slide Charts, Inc., 1786 W. Armitage Ct., Addison, IL 60101) permits the estimation of blood alcohol concentration based on body weight in pounds (90-260 pounds, in 10 pound increments), the number of drinks consumed (1-16, in ½ and one drink increments) and the number of hours spent drinking (1-16, in one hour increments). Blood alcohol levels of .05 percent

and greater are indicated in red as "danger zones". Brief instructions are listed on how to use the calculator to determine BAC based on the number of drinks consumed and body weight. A hypothetical example is cited on the back of the calculator. An equivalent of one drink is given as one ounce of 86 proof alcohol or approximately 12 ounces of beer. Effects at varying BACs are also listed. A note states that the calculator is only a guide, based on averages, and that certain factors like tolerance, food, medications, health and psychological conditions may influence blood alcohol concentration. Suggestions to use the calculator before drinking, and warnings of driving and drinking are also printed on the calculator. These alcohol nomograms are produced for the Arkansas Highway Safety Program, who supplied them at no cost to the investigator.

Know Your Limits Wallet Size Card nomogram condition. The Know Your Limits wallet size nomogram (Distilled Spirits Council of U.S., Inc., 425 Thirteenth Street, N.W., Washington, D.C. 20004, Suite 1300) permits the estimation of blood alcohol concentration based on body weight in pounds (100-240 pounds, in 20 pound increments), and the number of drinks (1-10, in one drink increments) for one hour of drinking. Blood alcohol levels of .04 percent and less are listed as "influenced rarely", .05 to .09 percent as "possibly" and .10 percent and greater as "definitely". A note states that .01 percent should be subtracted for each 40 minutes of drinking. A one drink equivalent is given as 1½ ounces of 80 proof liquor, 12 ounces of beer or 4 ounces of table wine. Information in bold print states that the card is a "chart for responsible people who may sometimes drive after drinking" and that the "surest policy is . . . don't drive after drinking!". On the back of the card is printed "this chart is only a guide, not a guarantee" and "driving after excessive drinking is dangerous and punishable by law". In addition, it is noted that the motor vehicle operator is presumed by law to be impaired when the BAC is above the .10 level. A suggestion is given that if a person's weight is between two of those shown on the card, they should use the lower weight in determining their blood alcohol

concentration. These alcohol nomograms were supplied at no cost to the investigator by the Distilled Spirits Council of U.S.

Alcohol Information Card Comparison Condition. This wallet size card outlined the penalties for driving while intoxicated (DWI) offenses established by Arkansas legislative acts 549 and 918 of 1983. One side of the card has a bold red "WARNING" label, below which the following statement reads: "ACTS 549 and 918 of 1983 have established new and stiffer penalties for DWI offenses". This card also states that "all motorists and law enforcement personnel should be aware of the severity of these penalties". The bottom of the card lists the name of the Attorney General of the State of Arkansas. On the other side of this card, the penalties for first, second, third and fourth offenses of the new legislation are shown in table form. Penalties include jail sentences, fines, alcohol treatment/education and the length of license suspension per offense.

Brief Instruction, Condition of Administration. Subjects in this condition received brief instruction about the alcohol nomogram they were assigned. For both alcohol nomograms conditions, subjects were given information on the following: 1) a description of the alcohol nomogram, 2) directions for it's use, and 3) examples of how it might be used.

This information was given by one of several research personnel who were assigned to oversee the alcohol information booth at the health fair. This information was given immediately upon distributing the nomogram to the subject. Research assistants were asked to keep the instruction brief.

A description of the alcohol nomogram included a statement that the alcohol card was developed to estimate blood alcohol concentration (BAC) and that BAC was a measure of alcohol's intoxicating effect. Directions on how to use the alcohol nomogram emphasized how to read and manipulate the variables for estimating blood alcohol concentration i.e. body weight, the number of drinks consumed and the time spent drinking. Examples given to illustrate how the alcohol nomogram might be used included it's use in making decisions about

drinking, and driving after drinking.

No Instruction, Condition of Administration. Subjects assigned to this condition received no information describing the alcohol nomogram, no directions on how to use it and no examples of ways in which it might be used. Subjects who asked questions about the alcohol nomogram were told that instructions printed on the alcohol card would answer their questions.

Dependent Variables

A 26-item "Alcohol Card Questionnaire" was used to collect data on subject demographics; frequency of drinking, and driving after drinking; knowledge of the number of drinks it takes to become legally intoxicated; use of the card to make decisions about whether or not to drive after drinking and whether or not to slow or stop drinking; and consumer evaluation of the card. The Alcohol Card Questionnaire was pretested on a group of university students and a group of university faculty, and revised on both occasions to eliminate ambiguous and redundant items.

Questionnaire items concerning consumer evaluation included items about whether or not the alcohol card: 1) was read by the subject, 2) caused the subject to think about their alcohol use, 3) was easy to understand, 4) would be recommended to a friend or family member, and 5) would continue to be used. These items were all scored using a yes-no categorical response mode.

Questionnaire items concerning knowledge of the number of drinks required to become legally intoxicated (i.e. 10% BAC) for one hour of drinking included a write in response. This item was scored as either: 1) correct ($\pm$ one drink based on the Drink/Drive Calculator for the body weight cited in the questionnaire), or 2) incorrect, including don't know. An additional analysis was conducted on this data to determine possible differences between conditions on over- and underestimating of the number of drinks for intoxication. Data were scored as: 1) correct, including underestimating the number of drinks, or 2) incorrect, including don't know and overestimating the number of drinks.

Questionnaire items concerning the use of the cards to make decisions about whether or not to drive after drinking, and to slow or stop drinking, were scored using yes-no categorical responses. Subjects who responded affirmatively to these questions were also asked to identify the actual number of times they had decided not to drive, or to slow or stop drinking, in the last month.

RESULTS

Table 1 shows the subjects reporting to have made drinking-related decisions by experimental (collapsed across conditions) and comparison groups. No significant difference was found between the experimental and the comparison groups on the frequency of subjects who used the alcohol cards to make decisions about whether or not to slow or stop drinking ($X^2 = 1.09$, df = 1, $p > .05$). A significantly greater number of subjects who received the alcohol information card reported making decisions about whether or not to drive after drinking, than did those who received alcohol nomograms ($X^2 = 3.55$, df = 1, $p < .05$). Nineteen percent of the comparison group made decisions related to drinking driving, compared to eight percent of the experimental group.

...PLACE TABLE 1 ABOUT HERE...

Those who used the alcohol cards to make drinking-related decisions were asked to identify the numbers of these decisions they made in the past month. T-tests revealed no significant differences between experimental and comparison groups on the number of times subjects decided not to drive, in the past month ($t(6) = 1.18$, $p > .05$). Also, no significant differences were found between experimental and comparison groups on the number of times subjects decided to slow or stop drinking in the past month ($t(5) = 0.00$, $p > .05$).

Chi-square tests revealed no significant differences between the two alcohol nomogram conditions on the number of subjects who reported to make decisions about whether or not to slow or stop drinking ($X^2 = .50$, df = 1, $p > .05$), as well as the number of subjects reporting to make decisions about whether or not to drive after drinking ($X^2 = .53$, df = 1, $p > .05$). No significant differences were found between the experimental conditions receiving brief

instruction and those not receiving instruction, on the number of subjects who reported making decisions about whether or not to slow or stop drinking (X^2 = .20, df = 1, $p > .05$) and the number of subjects who made decisions about whether or not to drive after drinking (X^2 = 1.45, df = 1, $p > .05$).

Table 2 shows the subjects accurately reporting and underreporting the number of drinks necessary to become legally intoxicated (.10 percent BAC) by experimental and comparison groups. No significant differences were found between experimental and comparison groups on the number of subjects who accurately identified the number of drinks required to become legally intoxicated after one hour of drinking (X^2 = 0.00, df = 1, $p > 0.5$). Both the experimental and comparison groups had the same percent (22) of subjects report accurately the number of drinks for intoxication.

...PLACE TABLE 2 ABOUT HERE...

A second analysis of the knowledge of the relations between alcohol consumption and blood alcohol concentration was conducted by examining the frequency of subjects who underreported the number of drinks for intoxication. Underreported amounts of alcohol use were examined because they are believed to be more desirable than overreports, even though they were not accurate. No significant differences were found between experimental and comparison groups on the frequency of subjects who identified either accurate or underreported responses of the number of drinks necessary for legal intoxication after one hour of drinking (X^2 = .02, df = 1, $p > .05$).

Chi-square tests revealed no significant differences between the two alcohol nomogram conditions on the number of subjects who accurately identified the number of drinks to become legally intoxicated (X^2 = 0.00, df = 1, $p > .05$), as well as the number of subjects who underreported the number of drinks necessary for legal intoxication after one hour of drinking (X^2 = .02, df = 1, $p > .05$). No significant differences were found between experimental conditions receiving instruction versus those which did not receive instruction, on the number of subjects identifying the accurate number of drinks for intoxication

(X^2 = 1.52, df = 1, $p > .05$), and the number of subjects underreporting drinks (X^2 = .25, df = 1, $p > .05$).

Table 3 shows the subjects reporting positive consumer evaluations by experimental and comparison groups. Chi-square tests showed no significant differences between experimental and comparison groups ($p > .05$) on the number of subjects who reported positive evaluations. Experimental and comparison groups reported similar percentages of positive evaluations for all five consumer items, including the following percentages for experimental and comparison groups, respectively: 1) Did you read the card? (86 and 83%), 2) Did the alcohol card cause you to think about your alcohol use? (53 and 54%), 3) Was the alcohol card easy to understand? (93 and 96%), 4) Would you recommend the alcohol card to a friend or family member? (83 and 84%) and 5) Do you plan to continue to use the alcohol card? (43 and 39%).

...PLACE TABLE 3 ABOUT HERE...

Chi-square tests showed no significant differences between the two alcohol nomogram conditions on all five of the consumer evaluation measures ($p > .05$). Chi-square tests also identified no significant differences between experimental conditions receiving brief instruction, and those not receiving instruction, on all of the consumer evaluation measures ($p > .05$), with the exception of one. A significantly greater percentage of subjects in the no instruction experimental condition reported to read the nomogram (95%), as compared to those who did receive instruction (80%) (X^2 = 4.94, df = 1, $p < .02$).

DISCUSSION

This study's results indicate that two commonly found alcohol nomograms are no more effective than information cards detailing new state legislated drinking driving penalties, on impacting decisions regarding drinking, driving after drinking, the development of knowledge of the relations between personal alcohol consumption and the legal level of intoxication, and consumer evaluation measures. These data suggest that we cannot assume that alcohol nomograms, no matter how novel, colorful, or seemingly well designed, will be effective in impacting health-related change.

Alcohol information cards had a significantly greater effect than alcohol nomograms, on whether or not an individual made decisions about driving after drinking. Several possible explanations may account for this result. One explanation may be that the layout scheme on the information card was more simple and direct, which may have made the card more likely to be perceived and utilized. This layout may have been particularly important in a setting where a greater amount of information, in verbal, audiovisual, and written formats, was competing for the attention of the individual (i.e. the health fair), and where time was a limited commodity.

A second explanation for the impact of the information card is that the content of the message, not simply the layout, was effective in eliciting change. In other words, the effectiveness of this type of information may be due to it's ability to capitalize on (or create) concern over "new and stiffer penalties for DWI offenses". The hypothesis that behavior is influenced by expected consequences is common to many behavioral science theories,[8-11] and has been recently examined as it relates to health behaviors such as drinking[12] and smoking[13]. These writers have stated that knowing the consequences that individuals expect from a particular behavior is necessary to understand that behavior, and is presumably important to the development of effective interventions. It may be that the alcohol information card, which emphasized the warning of stiff penalties including jail sentences, fines, alcohol treatment/education, and license suspension for DWI behavior, identified negative consequences with which this population was concerned.

Although the alcohol information card was more effective in its' effect on whether a person made drinking driving decisions, these findings must be tempered with the knowledge that no significant differences were found between the information card and nomogram conditions on the number of times subjects reported not to drive after drinking. In other words, even though more people using the information cards reported making decisions about whether or not to drive after drinking, these decisions did not necessarily lead to a reduction

in the reported number of drinking driving episodes. It is this measure, the frequency of driving after drinking, that is of greatest concern to health professionals and undoubtedly more difficult to modify.

This study found that alcohol nomograms were no more effective than the alcohol information card in increasing a person's knowledge of the number of drinks it would take to become legally intoxicated. This was a surprising finding since one of the apparent aims of alcohol nomograms is to inform people of the relations between the number of drinks and "legal intoxication". One explanation for this lack of knowledge gain is that alcohol nomograms are inadequately designed to illustrate: 1) how to use the nomogram to determine the relationship between their own alcohol consumption and BAC, and 2) how to apply this information to prevent adverse situational and personal consequences (e.g. a DWI).

This study also found that brief instruction accompanying the alcohol nomograms made no difference on dependent variables, except on the percent of subjects who reported to have read the nomograms. A significantly greater number of subjects who had not received instruction (95%) had read the nomograms, as compared to those who had received instruction (80%). It is possible that the instruction, although insufficient to affect the majority of the dependent variables, was adequate enough to cause some people to feel that they did not need to read the alcohol nomograms. These data suggest that very brief instruction has little useful impact when used in conjunction with alcohol nomograms.

This study's results may be interpreted as an indication of the necessity to continue research efforts to validate all types of alcohol nomograms, so that health professionals and consumers of these devices will have the necessary information available to select materials based on empirical evidence. Since a considerable number of subjects reported favorable reactions to the alcohol nomograms, it is recommended that the use of these inexpensive informational "tools" be cautiously explored. In particular studies are needed to test the validity of alcohol nomograms and the information they contain, using widely varying subject populations and innovative settings and conditions.

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TABLE 1

SUBJECTS REPORTING TO HAVE MADE DRINKING - RELATED DECISIONS BY EXPERIMENTAL AND COMPARISON GROUPS

Drinking Related Decisions	Experimental Group n (%)	Comparison Group n (%)	TOTAL n (%)
To drive after drinking*	8 (08)	11 (19)	19 (12)
To slow or stop drinking	8 (08)	8 (14)	16 (10)
TOTAL	16 (16)	19 (33)	35 (22)

* $p < .05$

TABLE 2

SUBJECTS ACCURATELY REPORTING AND UNDERREPORTING
THE NUMBER OF DRINKS FOR INTOXICATION BY EXPERIMENTAL AND COMPARISON GROUPS

* Accurate and Underreports of drinks	Experimental Group n (%)	Comparison Group n (%)	TOTAL n (%)
Accurate number of drinks	22 (22)	13 (22)	35 (22)
Underreported number of drinks	48 (49)	28 (48)	76 (49)

* Accurate responses defined as ± one drink based on the Drink/Drive Calculator for the body weight cited in the Alcohol Card Questionnaire.

TABLE 3

SUBJECTS REPORTING POSITIVE CONSUMER EVALUATIONS
BY EXPERIMENTAL AND COMPARISON GROUPS

Consumer Evaluations	Experimental Group n (%)	Comparison Group n (%)	TOTAL n (%)
Was read by the subject	85 (86)	49 (83)	134 (85)
Caused the subject to think about their alcohol use	50 (53)	31 (54)	81 (54)
Was easy to understand	81 (93)	50 (96)	131 (94)
Would be recommended to others	76 (83)	48 (84)	124 (83)
Would continue to be used	38 (43)	21 (39)	59 (42)